CONTRIBUTIONS TO A MORE EXACT KNOWLEDGE OF THE GEOGRAPHICAL DISTRIBUTION OF AUSTRALIAN BATRACHIA. No. v.

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(a) Batrachia of Tasmania.

The number of species of Batrachia assigned to Tasmania at different times has been as follows:—

1841.—One species (Duméril and Bibron, Erp. Gén. viii.; out of a total of eleven species described or enumerated from Australia and Tasmania).

1841.—One species (Mr. J. E. Gray, Capt. Grey's Journals, Vol. ii. App., p. 435; out of a total of sixteen—nominally seventeen—species catalogued from Australia and Tasmania, including the preceding).

1858.—Eight species (Dr. Günther, seven—one erroneously, *Crinia georgiana* [App., p. 134] not being a Tasmanian species—including *Pseudophryne bibronii*, in the Brit. Mus. Catalogue [1858]; subsequently increased by two species of Crinia [P.Z.S. 1864, p. 48]. A second record of *Pseudophryne bibronii* given in Ann. Mag. N. H. (3), xx. 1867, p. 55.

1868.—Seven species (Mr. G. Krefft, "Notes on the Fauna of Tasmania," including *Hyla verreauxii*, and a "Pseudophryne discovered by Mr. Masters, and probably new"; the remainder are included in Dr. Günther's Catalogue, but *L. peronii* therein mentioned only in the Appendix (p. 134) is overlooked). It is to be regretted that Mr. Krefft apparently neglected to place on record the complete list of species obtained by Mr. Masters.

1882.—Seven (? eight) [Mr. A. G. Boulenger, Brit. Mus. Catalogue, 2nd ed.]. Mr. Boulenger's revised list, the latest we have,

differs from Dr. Günther's by the exclusion of *Crinia georgiana*, and *Pseudophryne bibronii*, and the doubtful inclusion of *Hyla krefftii*. As Mr. Boulenger had at his disposal only the material utilised by his predecessors, it is evident that for at least thirty years fruitful collecting in Tasmania has been at a standstill, notwithstanding increased travelling facilities.

Through the kindness of two Members of the Society resident in Tasmania I am now enabled to make some additions to the Batrachian fauna. To Miss Lodder, of Ulverstone, my thanks are especially due for seven small consignments forwarded at different times, amounting to forty well-preserved specimens, representing seven species. I am also much indebted to Mr. A. Simson, of Launceston, for an interesting collection of fifteen specimens belonging to five species, all, however, represented in Miss Lodder's collections. Altogether I have examined representatives of seven species, of which four find a place in Mr. Boulenger's edition of the B.M. Catalogue; two (*Limnodynastes dorsalis* and *Crinia signifera*) are now recorded from Tasmania for the first time; and one (*Pseudophryne*) recorded by Dr. Günther and Mr. Krefft, but omitted by Mr. Boulenger, is shown to be correctly included in the Tasmanian fauna.

The number of Tasmanian species at present known, therefore, is ten (nominally eleven). Of these, the only species peculiar to Tasmania is *Crinia tasmaniensis*, Gthr. Excluding *Hyla krefftii*, the remaining nine—or varietal forms of them—occur in Southern Victoria, a condition of things quite in harmony with the views of Professor Spencer and Mr. A. H. Lucas as to the close relationship between the faunas of Tasmania and Victoria. The revised list now offered brings out one other point not previously evident, namely, that, few as the Tasmanian species are, four occur also in South-western Australia, and five in the colony of West Australia.

Much of the British Museum material was collected very many years ago, and, except in one instance (*H. ewingii* from Hobart), the habitats recorded are simply Tasmania or Van Dieman's Land. As the material examined by me is from the north coast or there-

abouts, I am not at present in a position to offer any remarks upon the geographical distribution of the species within the limits of Tasmania. Of the three species which have not come under my notice, two are known from Tasmania only by single specimens in the B.M. Collection, presented (prior to the publication of the first edition of the Catalogue in 1858) by Sir A. Smith, without information as to the collector's name.

Cystignathidæ.

1. Limnodynastes Peronii, D. & B.—The only specimen known from Tasmania is one presented to the British Museum Collection many years ago by Sir A. Smith.

2. L. tasmaniensis, Gthr.—*Hab.:* Longford (Miss Lodder), Launceston (Mr. A. Simson). Seven typical examples with a light vertebral stripe.

3. L. dorsalis, Gray.—*Hab.:* Ulverstone (Miss Lodder). Five specimens, of which four are dorsally spotted, with an incomplete light vertebral stripe; and one is unspotted and unstriped. (See also remarks on p. 675.) Three of these specimens have the vomerine teeth abnormally developed, so as to extend outwards beyond the level of the choanæ.

4. Crinia signifera, Gir.—*Hab.:* Ulverstone, Swansea, E. Coast (Miss Lodder); Launceston (Mr. A. Simson). There are also specimens in the Macleay Museum from Tasmania.

5. C. tasmaniensis, Gthr.—I have not seen an example of this species, which is known only from "several specimens" in the British Museum Collection. It is a smooth-bellied Crinia which should be easily recognisable by the following characters:—Toes fringed, subarticular tubercles moderate, two small metatarsal tubercles, upper and lower surfaces smooth; "the lower parts beautifully rose-coloured, largely marbled with black." Vomerine teeth are said to be absent.

6. C. lævis, Gthr.—*Hab.:* Ulverstone (Miss Lodder), Launceston (Mr. A. Simson). Previously known only from the single (type) specimen in the British Museum Collection, which must

have been in some respects a somewhat exceptional one, or at least not in perfect condition; though no description based on a single specimen of these variable little frogs can be perfectly satisfactory. The distinctive characters of the species according to the B.M. Catalogue are—vomerine teeth wanting, toes not fringed, subarticular and metatarsal tubercles indistinct, upper and lower surfaces smooth; "brownish-olive above, with small scattered yellow spots; lower surfaces spotted with brown."

From the examination of a good series of thirteen specimens I find that the description may be amended in several respects, as follows:—Vomerine teeth of the usual character present, seldom missing; ventral surface white with scattered brown or black spots, the "concealed surfaces" black and white marbled (least so, but sometimes slightly, on the backs of the thighs), the white suffused with rosy or rosy-pink all over, or occasionally chiefly about the groin, and the thigh-, knee- and tarsal-joints; but I have not seen a specimen—and I have seen only spirit specimens—without some evident indications of it. Some specimens have the ventral surface more dark-spotted than others, the tendency being for the spots to become larger posteriorly on the ventral surface, as well as on the legs. Some have indications of at least some subarticular tubercles, and occasionally of an inner metatarsal tubercle. Some have a few small scattered warts on the dorsal surface. Some have indications—especially immediately behind the eye—of an incomplete dark streak on each side of the head. Occasionally, as in var. *froggatti*, a specimen is met with showing one or a number of light spots somewhere on the dorsal surface, but not constant in position; they may even be suffused with rosy. One very light Tasmanian specimen has a rosy wash (post mortem ?) nearly all over the upper surface.

When these characteristics are allowed for I am prepared to admit that the Victorian frog described by me as *Crinia froggatti* (P.L.S.N.S.W. (2) vi. 1891, p. 275) is at most only a continental variety of *C. lævis*. The largest of the Victorian specimens (26 mm. from snout to vent) are somewhat smaller than the largest Tasmanian specimens (30 mm); the concealed surfaces are somewhat

more extensively marbled with an intenser black, the rosy or carmine suffusion brighter (even in specimens which have been in spirit for six years); with more pronounced indications of a broad, dark dorsal band commencing between the eyes, and of the dark stripe on each side of the head. As in the Tasmanian examples, vomerine teeth are but seldom missing.

Of *Crinia victoriana*, Blgr., (also originally described from a single specimen) I have now a good series, for which I am indebted to the kindness of Mr. Hugh Copeland, Junr., late of Warragul. This is another smooth-bellied form, without fringed toes, with indistinct subarticular and metatarsal tubercles, and with vomerine teeth. It is readily distinguishable to the eye, but it is very difficult to formulate any satisfactory distinctive differences other than those of colour and pattern. In details the specimens differ among themselves in both these respects, and yet there is usually no difficulty in distinguishing them from examples of *C. læris*, var. *froggatti*. The suffusion on portion of the concealed surfaces is more restricted, and is of a different tint, coppery or coppery-red; and a very characteristic arrangement is some modification of a single subcircular coppery spot with a lighter central portion on each loin; occasionally the back and front of the thighs, or even the ventral surface, may show a wash of it. Some specimens exhibit a fairly complete broad dark (brown or black) dorsal band commencing between the eyes; more often the anterior transverse [the "black transverse band between the eyes" of Mr. Boulenger's description] and the lateral margins are indicated, but with much of the central portion missing, or the whole band is represented only by blotches and streaks, the general effects produced being grey or brown variegated with black. Lower surface dark-spotted on a light ground (sometimes with a bluish tinge) which is itself minutely dark-spotted, sometimes very much so, especially on the throat; sometimes the large dots are wholly wanting or nearly so, particularly on the throat; or sometimes sparsely light-spotted or with patches of coppery, the flanks often much dotted; "vent in a large triangular [often light-edged] black spot," frequently continued on each side as a dark band on the

lower portion of the back of the thighs; concealed and lower surfaces of the legs much marbled or spotted with black. Usually there are indications of a dark streak on each side of the head, commencing on the snout, most conspicuous immediately behind the eye. Light or whitish spots—one or several—sometimes occur in a casual manner on the upper surface of the body or limbs.

Bufonidæ.

7. Pseudophryne bibronii, Gthr.; *var.* semimarmorata, Lucas. —*Hab.:* Ulverstone (Miss Lodder); Launceston (Mr. A. Simson). Three specimens, intermediate in character between ordinary examples of *P. bibronii* and the extreme form of the Victorian variety which Mr. Lucas has described as *P. semimarmorata*. The three Tasmanian specimens are very like some Victorian examples I have seen, portion of a number kindly given to me by Mr. Lucas, and have the throat, or all but a little patch near the symphysis, marbled like the ventral surface. From the presence of these and other intermediate forms I am constrained to regard *P. semimarmorata* as not entitled to more than varietal rank. I have not seen any specimens partially marbled on the lower surface except from Victoria and Tasmania; and it was probably to specimens like mine that Mr. Krefft's remark, already quoted, applied.

Hylidæ.

8. Hyla peronii, D. & B.—The only specimen known from Tasmania is one presented to the British Museum Collection many years ago by Sir A. Smith.

9. H. ewingii, D. & B.—*Hab.:* Ulverstone (Miss Lodder); Launceston (Mr. A. Simson). This is a very interesting species, with several well-established varieties. The older naturalists were not in a position to appreciate the real state of the case, for their observations were based on the examination of single specimens, or of too scanty series from only a portion of the area over which the species is now known to range. Under such circumstances it is hardly surprising that probably no less than

four species have been founded only on variable or abnormal specimens of *H. ewingii*.

Mr Boulenger, with a series of only about seventeen specimens for reference (10 from Tasmania, 1 from Melbourne, 4 from Australia, and 2 of var. *calliscelis* from King George's Sound), was the first to recognise and allow for a considerable amount of variation. His predecessors without exception had reported the fingers of *H. ewingii*, even of Tasmanian specimens, to be free or quite free. Steindachner and Keferstein had, however, only a single specimen apiece from New South Wales, and in these it is possible that the fingers were free. The French naturalists also attached unnecessary importance to the presence or absence of "tubercules cutanés." The size of the tympanum in relation to that of the eye is likewise variable. Mr. Boulenger made some necessary allowances in these respects, and then proceeded to reduce *H. calliscelis*, Peters, to the rank of a colour-variety of *H. ewingii*. These were important steps in the right direction. But Mr. Boulenger had no specimens, except of the so-called *H. krefftii*, from New South Wales, otherwise he might, with advantage, have gone even further, as I feel impelled to do as the result of the examination of a fine series of more than one hundred specimens from three colonies.

Of seventeen Tasmanian specimens* all but two have a quite noticeable rudiment of web on the fingers, more pronounced in some specimens than in others. The unwebbed portions may or may not, or be partially fringed; if the fringe is present the rudiment of web between two adjacent fingers, may become continuous with it. Sometimes the rudiment of web between the 3rd and

* Ten Tasmanian specimens of *H. ewingii* from an unspecified locality, kindly forwarded to me by Mr. Alex. Morton, have not been taken into account. They were forwarded in a cardboard box, and were so crushed and dried up in the mail bag in transit as to be for the most part irretrievably spoilt as specimens. As far as I can judge they are very much like the other Tasmanian specimens I have examined, and among them is one which under more favourable circumstances would have been a good example of var. *calliscelis*.

4th fingers appears to be most pronounced, and then the 3rd digit is more or better fringed on that side than on the other. In two specimens the fingers are not so well fringed nor is the rudiment of web so much developed as in the others; they appear to be only examples of the typical form of *H. ewingii* with the fingers and toes less fringed and webbed than usual. The seventeen specimens are separable into two groups: one of twelve specimens to which the description of the colour-pattern given in the B.M. Catalogue (2nd ed.) applies very well; and a group of five specimens in which, irrespective of sex, the groin, loins, backs of the thighs, or sides of the body, or some of these, show some dark spots or streaks not provided for in the description. But the members of the second group have not the fingers and toes any less webbed than those of average specimens of the first. Accordingly I should call the individuals of the first group typical examples of *H. ewingii*; some of the others I should call a trivial colour variety, of no great importance by itself; but at least three of them, in which the spots are not merely brown like the ground colour of the back, but blackish or bluish-black, are quite entitled to be called var. *calliscelis*. One of these last shows a dark streak on each side of the body (interrupted on one side) anteriorly joining the dark streak on the temporal region, and posteriorly bending round to join the dark dorsal band. In some New South Wales specimens a row of spots is seen in a similar position. In the specimen referred to, as in other Tasmanian examples, the region of the dark dorsal band is not merely a good deal speckled with blackish, but it is decidedly edged with it laterally and anteriorly.

In a series of thirty Victorian specimens from one locality, more uniform in colour than the Tasmanian specimens, the fingers have a noticeable rudiment of web as in most of the Tasmanian examples; twenty are unspotted; five have one or several small dark (ground-colour) spots on a yellow back ground on the backs of the thighs, and one has a few dark spots on one side about the flanks. Of a second series of seven specimens from another locality, three are unspotted and the rest are slightly spotted on

the backs of the thighs. Finally a single specimen from another locality (Mt. Lofty, Vic.) kindly given to me by Mr. Frost, has a bluish-black spot in the groin extending on to the loins, or on one side with a separate spot on the loins, and a blackish spot and some brown markings on the back of each thigh. The last of these I should call a good example of var. *calliscelis;* the others typical examples of *H. ewingii*, or a trivial colour-variety.

An extensive series of New South Wales specimens from various localities on the coast and on the tablelands is separable into two or three groups: one of unspotted specimens with a distinct rudiment of web, in some I think not appreciably more in amount than in average Tasmanian and Victorian specimens, in others a little more (*H. krefftii*, so-called); a second group in which one or two large dark spots, or a group of smaller ones, are present on the sides of the body or the backs of the thighs, but more often and constantly on the loins; and a third group in which in addition the back and the sides, or the upper surface of the limbs, are heavily blotched, streaked or spotted, but not uniformly or to the same extent in a series of specimens from the same locality. Now the webbing of the fingers of the spotted New South Wales examples certainly varies in amount from very little indeed to nothing. I have some specimens whose fingers I should call free; and others of which one can say that they are slightly fringed or have a just recognisable rudiment of web, and that is about all. They are certainly appreciably less webbed than either the unspotted specimens, or than average Tasmanian and Victorian specimens. Such rudiment of web as there is seems to be merely the continuation right round of the slight fringe of adjacent fingers, or, in other words, of the junction of the fringes of two adjacent fingers. But in var. *krefftii*, as in average Tasmanian and Victorian specimens, there seems to be in addition a slight development of web as well.

What is true of the fingers, applies also to the toes, the webbing of the latter varying in amount directly as that of the fingers.

Professor Spencer in the Report of the Horn Expedition (Part ii. Zoology, pp. 157 and 167) has discussed the question of the

value of the *amount* of the webbing as a generic and specific character; and he adduces instances of variation in the amount in the same species (*Chiroleptes platycephalus*, and *Heleioporus pictus*). I have also pointed out a similar state of things in Mixophyes. Similar variations are presented by *Hyla cærulea* and *H. peronii*, as, for example, when specimens from the moist subtropical Northern River Districts are compared with others from the drier inland districts. Dr. Günther and Mr. Boulenger have allowed for variation in this respect in some of their descriptions. Dr. Günther says of Pelodryas (*H. cærulea*), "fingers one-half or one-third webbed"; and of *H. peronii*, "fingers one-fourth webbed. Mr. Boulenger says of the latter, "fingers half-webbed or nearly so," though even this is an insufficient margin; and of *H. rubella*, "fingers free or with a slight rudiment of web; toes two-thirds or three-fourths webbed." *H. ewingii* is simply another addition to the list of species in which the amount of the webbing of the fingers and toes is not a constant quantity. When allowance is made for this, then *H. krefftii* falls into, what I believe is, its proper place as the eastern coastal representative of the typical form of *H. ewingii*. If *H. ewingii* may comprehend var. *orientalis*, which is less webbed, it would obviously be illogical to exclude a variety (var. *krefftii*) because it may be a little more webbed; for according to the B.M. Catalogue (2nd ed.) *H. krefftii* is "very closely allied to *H. ewingii*, but differing in the more distinct web between the fingers, and the more extensive web between the toes, it reaching the discs of the third and fifth."

The difficulty in the way of finding a satisfactory general expression for a quantitative estimation of the web is that all the digits, and sometimes the two sides of the same digit, are not relatively equally webbed, and also that their unwebbed portions are or may be fringed, the true web then being reinforced by the fringe if well developed. It is thus to some extent a question of whether fringe is to count as web. If so, but not I think otherwise, then in some specimens of var. *krefftii*, as Mr. Boulenger says, the webbing may extend to the discs of the 3rd and 5th toes, or more often only to that of the 5th That being so, how-

ever, I cannot see that a similar statement is not equally applicable to some Tasmanian and Victorian specimens of *H. ewingii*. The following is I think a fair estimate of the webbing of *H. ewingii* and its varieties:—Fingers free, fringed, or fringed and with a rudiment of web. Toes: the third and fifth webbed to about the level of the subarticular tubercle immediately proximad of the disc, or beyond and by continuity with the fringe extending to the discs or nearly so: the other toes less webbed.

I have not seen specimens of var. *calliscelis* from South-West, or South Australia, but it seems to me that the case for *H. ewingii* may be summed up as follows:—

In Tasmania we find the typical unspotted form of *H. ewingii*, together with a slight and unimportant colour-variety, and var. A.—var. *calliscelis*.

In Victoria also we find the typical form, together with a trivial colour-variety, and var. *calliscelis*, the latter also extending to South Australia (Peters' two Adelaide types of *H. calliscelis)* and to West Australia (two specimens from King George's Sound, in the British Museum, previously recorded by Dr. Günther under the name of *H. ewingii*).

In New South Wales we find an unspotted form with the fingers and toes as much or even slightly more webbed than the typical form (var. B.—var. *krefftii*): and a more widely distributed spotted variety, less webbed than the typical form (var. C.—var. *orientalis*, var. nov.), and in which the discs of both the fingers and the toes are certainly smaller than usual.

Var. *krefftii*—but not *H. ewingii*—is recorded in the B. M. Catalogue (2nd ed.) from Port Denison, Q. In New South Wales it is rather a rare frog, and is confined to the coast. I have seen altogether about twenty-five specimens from three localities all within a distance of about 60 miles from Sydney. The majority were found under logs in the cold months, but a few under loose bark on tree trunks or between the bases of the fronds of Zamias. Mr. Krefft's favourite locality for this species near Randwick has been devastated during the last few years; and it is now difficult to procure specimens near Sydney. Var. *orientalis* is one of our

commonest frogs on the coast and on the table-lands, and, as far as my experience goes, is strictly terrestrial in its habits. The most southerly record for it known to me is the Mt. Kosciusko Plateau, whence I have a single specimen which is as strikingly blotched and streaked as some of those from Lucknow; and yet these much-spotted specimens are not altogether devoid of a trace of web on the fingers. It may be noted, however, that both the localities mentioned are west of the Dividing Range.

On a previous occasion I recorded a Victorian specimen which in life had a good deal of bright green about the upper surface. If other specimens like it can be found, this might very well be treated as another colour-variety. The green soon faded in spirit, and the specimen now looks very like some of the ordinary light coloured specimens. New South Wales specimens vary from light silvery grey to dark brown, the back and front of the thighs yellow in the breeding season; but I have never seen a living specimen with any indication whatever of a green tint on any part of the body.

The list of Australian frogs is still undesirably cumbered with species known only from single specimens, which need rediscovering or the correct determination of their alliances. Mr. Boulenger has endeavoured to deal with some of them; but there is still a considerable balance, of which doubtless some will be rediscovered in time, but others, I cannot help thinking, have been founded only on variable, imperfectly preserved, or abnormal individuals.

H. calliscelis, Peters, and *H. krefftii* being provided for, some consideration may be devoted to the claims of *H. verreauxii*, A. Dum., and *H. parridens*, Peters. The first of these was described from New Holland by A. Duméril in 1853, in the belief that while it was allied to *H. ewingii*, and agreed with it in having the fingers free, it was yet specifically different by its smooth back, and its system of colouration. The first of these characters is of no importance. As to the second, if *H. verreauxii* is entitled to any consideration at all, it is at the most only as a colour-variety of *H. ewingii* in which there is absent "une bande noire étendue de la narine à l'épaule, et bordée, en dessous, par une

ligne jaune très fine et plus courte," which, he says, is always present in *H. ewingii*. The colouration of preserved specimens of *H. ewingii* differs within such considerable limits, according as the individuals were exposed to strong light or were taken from or kept in a dark place before preservation; according also as whether the dark dorsal band commencing between the eyes, and the canthal and temporal streaks are very dark or very faint, or whether the head and back are speckled all over with blackish as may or may not be the case, &c., that A. Duméril's supposed differences carry little weight. The only small Hylas known to us at the present day with a colouration at all like that of *H. ewingii*, and for which from a casual inspection it might be perhaps be mistaken, are *H. rubella*, *H. dentata*, and possibly *H. adelaidensis;* but an examination of the vomerine teeth of the first two, and the details of the colouration of the third, alone would prevent any misconception. *H. verreauxii* was in all probability founded on smooth specimens of *H. ewingii* which were bleached, or faintly and unusually coloured: in which case the name is an absolute synonym of *H. ewingii*. The only other alternative seems to be that *H. verreauxii* is a colour-variety of *H. ewingii*, which has yet to be rediscovered, and of which only the types have ever been seen. Mr. Krefft was certainly mistaken in supposing that he had identified *H. verreauxii*, A. Dum., as common at Sydney, or the Clarence River; in both cases I think he possibly confounded it with *H. dentata*, at that time imperfectly known, as neither *H. ewingii* nor any of its varietal forms has yet been recorded from the Clarence or Richmond Rivers.

H. parvidens, Peters, was founded in 1874 on a single specimen from Port Phillip, but is still unknown to Victorian naturalists. Admittedly it differs from *H. ewingii* chiefly in respect of the smaller tympanum (one-third the diameter of the eye), and the slightly developed vomerine teeth. Since from the examination of only about seventeen specimens Mr. Boulenger found it necessary to allow for a variation in the size of the tympanum of from "one-half to two-thirds that of the eye," it seems to me that it need not be a matter for any surprise if, when a more representative

series were examined, it should be found that this allowance was insufficient. As a matter of fact some of the Victorian and other specimens do seem to have a smaller tympanum than usual, about one-third that of the eye. One such specimen is of especial interest, inasmuch as the vomerine teeth are normal on one side, but absent on the other. Of two other Victorian specimens one (half-grown) appears to have the vomerine teeth not perceptibly developed; the other has them on one side strongly developed, on the other only slightly. Other instances of abnormal vomerine teeth, not including Crinia, have come under notice. In three only out of six or seven species of Limnodynastes do the vomerine teeth normally extend outwards beyond the choanæ. Three out of my four Tasmanian specimens of *L. dorsalis*, and three out of four variegated Sydney specimens of the same species have the vomerine teeth even more extensively developed than in specimens of those species in which the extension beyond the level of the choanæ is normal. If *L. dorsalis* were known only from unspotted specimens with normal vomerine teeth, and spotted or variegated examples like all but one of mine were then discovered, it would be a very pardonable supposition in the absence of intermediate forms that two distinct species were really represented. *H. parvidens* is known only from a single example, which may very well have been only a light-coloured specimen of *H. ewingii* without definite bands or streaks, with imperfectly developed vomerine teeth, and with a smaller tympanum than usual; and if so the name *H. parvidens* would become an absolute synonym of *H. ewingii*.

9 bis. H. KREFFTII, Gthr.—Mr. Boulenger's doubt is not as to the identity of the species but as to the correctness of the locality label. My experience would lead me to suppose that Mr. Boulenger probably had a Tasmanian example (especially if collected by Dr. Milligan) of *H. ewingii* a little more webbed than he was accustomed to see.

10. H. AUREA, Less.—*Hab.*: Burine, Emu Bay (Miss Lodder). Three specimens with a light vertebral stripe, as is common in western examples.

(b) The Batrachia of West Australia.

The number of species assigned to West Australia at different times has been :—

1841.—One species (Duméril and Bibron, *op. cit.*)

1841.—Six species—nominally seven, *H. bioculata* and *H. adelaidensis* being treated as distinct—(Mr. J. E. Gray, *op. cit.*).

1858.—Nine species—nominally ten, *Myobatrachus* and *Chelydobatrachus* being treated as distinct—(Dr. Günther, *op. cit.*).

1867.—Five additional species either from Mr. Duboulay's collection or forwarded by Mr. Krefft (Dr. Günther, Ann. Mag. Nat. Hist. (3), xx., p. 53). Total, fourteen species.

1882.—Fourteen species (Mr. Boulenger, *op. cit.*). That is to say, without additional material, Mr. Boulenger's revised list of species practically differs from Dr. Günther's only by the recognition of *Myobatrachus* and *Chelydobatrachus* as identical, and the substitution of *Pseudophryne guentheri*, n.sp., for *P. bibronii*.

Of these fourteen species I have seen representatives of nine, together with examples of six others not previously recorded, one of which does not quite satisfactorily agree with the description of any known species For the data on which my observations are based I am largely indebted to Messrs. E. P. Richards, H. Richards, R. Helms, and especially to Mr. A. M. Lea, who have most kindly taken some trouble to collect and forward specimens to me. By the courtesy of Mr. Masters, Curator of the Macleay Museum, I have also been able to examine the specimens collected by Mr. Froggatt in the neighbourhood of King's Sound in 1887, part of the general collections referred to by Sir William Macleay (P.L.S.N.S.W. [2], ii. p. 1017). And by the kindness of Professor Baldwin Spencer, of Melbourne, I have been able to see the specimens brought back by the Calvert Expedition, which were collected by Mr. G. A. Keartland while stationed at the junction of Fitzroy River and Margaret Creek, about 150 miles from Derby.

The number of species at present assignable to West Australia is twenty; but one or two of these need confirmation.

In the following list, for the sake of completeness, the localities recorded in the B. M. Catalogue are given within square brackets :—

CYSTIGNATHIDÆ.

1. LIMNODYNASTES DORSALIS, Gray.—*Hab.* : [West Australia, Houtman's Abrolhos], Perth (Mr. H. Richards), Geraldton (Mr. A. M. Lea). The difference in the colour pattern of eastern and western specimens of this species is very striking. Six western specimens are very fairly represented by Gray's figure of the type (Eyre's Journals, Vol. i. App. p. 405), in which the dorsal surface shows rather large irregular insuliform dark spots, and a white vertebral stripe. The common eastern form is almost uniformly dark, without spots (except light ones on the outlying parts), and without a vertebral stripe, and is very fairly represented (but the back and head are rather light) by Steindachner's figure (Reise Novara, Amphibia, t. ii. fig. 11, under the name of *Heliorana grayi*). This is the common widely distributed eastern form, but with it in the neighbourhood of Sydney—whence come all the New South Wales specimens I have seen—there occurs a variety of a smaller size, in which the back is usually more or less variegated with lighter without the dark ground colour being broken up into definite spots, and with a more or less complete light vertebral stripe. In Victoria also there are two varieties, of which I have seen only the unspotted variety, from Warragul. Sir Frederick McCoy has figured a specimen of the variety with a variegated dorsal surface showing incomplete spots (Prod. Zoology of Vict. Dec. v. Pl. 42, fig. 2) under the name of the Common Sand-Frog, between which and specimens more like that figured by Gray he says there are intermediate varieties. Of five Tasmanian specimens in my possession, one is unspotted and unstriped, and four are spotted, with an incomplete vertebral stripe. In the spotted forms the spots are smaller and more numerous, but not quite so definitely marked as in the western specimens, and the vertebral stripe is not so complete. The point to which I wish to direct attention is this. Tasmanian examples show a fairly established differentiation into a spotted variety, with

at least an incomplete vertebral stripe, and an unspotted variety without a dorsal stripe. In Victoria the differentiation seems to be equally well established. In Western Australia there seems to be only the spotted variety, but in this the pattern has become more definite and accentuated, and the vertebral stripe more striking. In New South Wales we get commonly an unspotted variety, and more rarely a variegated but not satisfactorily spotted variety.

2. Limnodynastes ornatus, Gray.—*Hab.:* Junction of Fitzroy River and Margaret Creek (Calvert Expedition; two specimens).

3. Crinia georgiana, Bibr.—*Hab.:* [King George's Sound]; Mt. Barker, and Bridgetown (Mr. A. M. Lea; two specimens); Pipe Clay Creek, near Jarrahdale (Mr. E. P. Richards; two specimens). Of the four specimens two are adult, and two less than half-grown. One adult has vomerine teeth; in the other they are present on one side only. Of the juveniles one has vomerine teeth; in the other they are altogether missing. No two of the specimens are exactly alike in colour and pattern. In the two adults and in one young one (without vomerine teeth) the concealed surfaces for the most part have the usual carmine suffusion. The young one with vomerine teeth has the chest and throat dark-spotted in an unusual manner; and is entirely without the carmine suffusion, yet it is not a smaller specimen than the other which has it. One adult (♂) has the throat dusky. One adult and one young one have a light transverse line with a pinkish tinge on the back of the thighs, and a fine light vertebral line ending at the vent. No perfectly satisfactory account of this interesting species can be given without a good series of specimens.

4. Crinia signifera, Gir.—*Hab.:* [Abrolhos, and West Australia]; Mt. Barker, Donnybrook (= Preston), Bunbury, Newcastle, Perth, and Jarrahdale (Mr. A. M. Lea; twenty-seven specimens). Not less variable than, and with analogous variations to, the eastern form, including a smooth-backed variety, which seems hitherto to have escaped record.

5. Crinia leai, sp. nov.

Allied in some respects to *C. tasmaniensis*, but differing by the presence of vomerine teeth, and of only one (the inner) metatarsal tubercle; in some respects also to *C. lævis* and *C. victoriana*, but differing by a tendency to fringed toes, and to better defined subarticular and metatarsal tubercles; and differing from all of them in the details of colouration, especially of the ventral surface, and in the absence (apparently constant) of rosy or coppery suffusions from the concealed surfaces.

Vomerine teeth of the usual character generally present. Snout rounded; nostril a little nearer to eye than to tip of snout; tympanum hidden. First finger shorter than second; toes sometimes fringed, sometimes not; subarticular tubercles on the whole fairly distinct, not so conspicuous on the fingers; a small inner metatarsal tubercle. Upper and lower surfaces, except for a small granulate area on the backs of the thighs close to the median line, smooth. Blackish-grey (in one specimen very much lighter than usual), a broad dorsal black (in the light specimen olive-brown) often light-edged band commencing between the eyes, extending backwards nearly to the vent, bifurcate posteriorly to a varying extent, sometimes for more than half its length [in three specimens the band is represented only by a transverse mark between the eyes, or by this and some dorsal spots]; indications of a dark streak on canthus and snout; upper lip with a few dark spots; a dark spot immediately behind eye, and one or two over shoulder; upper surfaces of limbs sometimes transversely dark-barred; vent at the apex of a triangular dark, often light-edged, spot extending on each side a little way along the lower edge of the back of the thighs: lower surface of tarsus, metatarsus, and toes black, usually light-edged; lower surfaces closely and minutely dark-dotted (brown) all over except for a number of small scattered unpigmented areas which show as light specks, sometimes with a bluish tinge. Largest specimen 29 mm. from snout to vent.

Hab.—Bridgetown (Mr. A. M. Lea; seven immature specimens); Pipe Clay Creek, near Jarrahdale (Mr. E. P. Richards; three specimens). Mr. Richards kindly sent off his three speci-

mens alive; but unfortunately they died in transit, and by the time they reached me two (the largest specimens I have seen) had deteriorated considerably, the condition of one of them being beyond repair. I hope at some future time to be able to supplement the above description from the examination of more satisfactory adult material than I have yet seen.

The discovery of this West Australian smooth-bellied Crinia is very interesting, as its allies are exclusively Victorian and Tasmanian. I do not propose at present to discuss the propriety or otherwise of including all the smooth-bellied Crinias under a single comprehensive species. It is a question which can only be discussed with profit when good series of all of them can be compared; and at present one, *C. tasmaniensis*, is known only from the types in the British Museum. The species are very variable, and some characters which in other genera are available for classificatory purposes are here of negative importance only.

6. Hyperolia marmorata, Gray.—*Hab.*: [West Australia; one specimen (the type)]. The occurrence of this species needs confirmation, the only other localities recorded for it being in New South Wales and Queensland.

7. Chiroleptes australis, Gray.—*Hab.*: [Nicol Bay; one specimen].

8. Chiroleptes albopunctatus, Gthr.—*Hab.*: King's Sound, and Derby (Macleay Museum, collected by Mr. W. W. Froggatt); Junction of Fitzroy River and Margaret Creek, N.W. A. (Calvert Expedition). The species most numerously represented in both collections (more than twenty specimens).

9. Chiroleptes brevipalmatus, Gthr.—*Hab.*: King's Sound, N.W.A. (Macleay Museum; collected by Mr. W. W. Froggatt); Junction of Fitzroy River and Margaret Creek (Calvert Expedition).

10. Heleioporus albopunctatus, Gray.—*Hab.*: [Swan River, W. Australia, and N.W. Australia]; Perth (Messrs. H. Richards, and A. M. Lea; two specimens); Albany (Mr. R. Helms; one specimen). This is another species which, like *L. dorsalis*, presents a spotted and an unspotted variety. One with white dorsal spots,

two (juv.) without. The first of these is a breeding male in fair condition. In this species, as in the eastern frog described by me as Philocryphus (but which, if the generic definition of Heleioporus be amended in respect of the tympanum, I am now prepared to merge in the latter), the most striking secondary sexual (♂) character is the presence of black horny conical tubercles on the upper surface of one or more of the fingers of each hand, much the largest of which is the proximal one on the first finger. This, unlike the small ones, has a bony core. Under some circumstances, possibly after the breeding season is over, the black horny capping of this tubercle, and the small coreless tubercles altogether, are shed. The only male in the B.M. Collection—the type figured by Gray—is in this condition, the description reading, "male with a conical tubercle on the inner side of the first finger."

H. pictus differs from both *H. albopunctatus* and *H. flavoguttatus*, and resembles the species of Limnodynastes, in having only blackish rugosities on the first and second fingers of both hands. In *H. flavoguttatus* there may be from seven to ten or fewer (the number is not constant) black tubercles on the first, second, and third fingers of each hand. A fine male which I kept in captivity for some months was well provided with tubercles when I caught him; but on examining him after death I found that all the small tubercles, and the black capping of the two large ones, had disappeared, leaving only the bony core of each of the latter. In my single male specimen of *H. albopunctatus*, the first finger of the left hand has only the large tubercle; the first finger of the right hand has three, the large proximal one, and two small ones: these are all there are, but under favourable circumstances probably more may be present.

Bufonidæ.

11. Pseudophryne australis, Gray.—*Hab.*: [Swan River one specimen only (the type)]. The only specimen known from West Australia was presented to the British Museum by Mr. J. Wright in 1835. Confirmation of the occurrence of the species in West Australia is therefore very desirable. If correctly attri-

buted to West Australia, then, among Australian Batrachia, it offers perhaps the most remarkable case of discontinuous distribution. In Eastern Australia its distribution is somewhat restricted, so that it might be called rather a local species. I have taken specimens as far north as Gosford, as far west as Mount Victoria, and as far south as Illawarra, all within a radius of about 70 miles from Sydney, and in intermediate localities; but outside the area mentioned there is no evidence at present of the occurrence of the species in New South Wales, or in any other of the colonies save West Australia (for Mr. Wright's specimen in the B.M. Collection; and for two specimens collected by the Elder Expedition at the Fraser Ranges, but which I cannot help thinking were recorded by mistake for *P. guentheri* [possibly without specimens for comparison]).

12. Pseudophryne guentheri, Blgr.—*Hab.* : [Swan River, and N.W. Australia]; Mt. Barker, Newcastle, Perth (Mr. A. M. Lea; seventeen specimens); King George's Sound (Macleay Museum). The two well-developed metatarsal tubercles on each foot are very characteristic, and call to mind those of Myobatrachus, and inland (N.S.W.) specimens of Hyperolia. They are probably of effective use in burrowing.

13. Myobatrachus gouldii, Gray.—*Hab.* : [W. Australia, Houtman's Abrolhos, and Swan River]; Perth (Mr. A. M. Lea). Five young specimens (about 17 mm. from snout to vent) about the same size, but very much smaller than that figured by Gray. In the B.M. Catalogue (2nd ed.) Myobatrachus is said to have the pupil erect. In my specimens I should call the pupil horizontal. Mr. Lea kindly informs me that he found the specimens at the side of a Termite nest, while rooting about in search of Termite parasities and messmates. He says: "The termitarium looked like a tree-nest which had fallen and become imbedded in the ground. The outer portions of the nest were disused and rotten; and living in, or close at hand, and apparently subsisting upon, the decaying matter, were numbers of the larvæ of a common fly. Several hundred larvæ and pupæ were obtained, and among them at intervals, and at a depth of 2-5 inches from

the surface, were found the five toads forwarded to you. The dipterous larvæ probably supply them with food." Possibly also Myobatrachus, like the Indian Cacopus, is normally a termite-feeding species. The habits, and especially the breeding habits, of this interesting species are well worth investigation. Mr. Lea also adds: "When alive the abdominal surface is marked with many small greyish irregular spots, especially at the sides, which seem to disappear in spirit." Four of the specimens show to a varying extent a fine light vertebral line (not extending on to the head); one of them is dorsally more dark-spotted than the others.

HYLIDÆ.

14. HYLA CÆRULEA, White.—*Hab.:* [Nicol Bay; one specimen] Junction of Fitzroy River and Margaret Creek, N.W.A. (Calvert Expedition; one specimen).

15. HYLA PERONII, Bibr., and var. ROTHII, DeVis.—*Hab.:* King's Sound (Macleay Museum; several specimens collected by Mr. W. W. Froggatt).

16. HYLA RUBELLA, Gray.—*Hab.:* [Nicol Bay, Abrolhos; one specimen from each].

17. HYLA EWINGII, D. & B., var. CALLISCELIS, Peters.—*Hab.:* [King George's Sound; two specimens].

18. HYLA ADELAIDENSIS, Gray.—*Hab.:* [West Australia, and King George's Sound]; Perth (Messrs. A. M. Lea and H. Richards; ten specimens); Albany (Mr. R. Helms; one specimen).

19. HYLA AUREA, Less.—*Hab.:* [King George's Sound, Swan River, and W. Australia]; Perth (Messrs. H. Richards and A. M. Lea; numerous specimens); Donnybrook (Mr. A. M. Lea); near Pipe Clay Creek, Jarrahdale (Mr. E. P. Richards).

20. HYLA LATOPALMATA, Gthr.—*Hab.:* King's Sound (Macleay Museum; one adult collected by Mr. W. W. Froggatt); Kimberley, N.W.A. (Mr. R. Helms; four specimens, not quite half-grown). This species occurs on both sides of the Dividing Range in New South Wales; but the only other record for it is Port Denison, Q.

The localities mentioned in the foregoing list lie either to the north and north-east of Geraldton, or to the south-west and south

of Nickol Bay. Of the Batrachia inhabiting the considerable interval between Geraldton and Nickol Bay we are quite ignorant. In the present state of our knowledge the western species may then be arranged in two geographical subdivisions, a south-western group, and a north-western group. Where, or to what extent, these two faunas overlap or commingle we do not know. Our knowledge of both of them, and especially that of the north-west must be very far from being complete, for three south-western species occur also at Port Essington without being known as yet from any intermediate locality.

(*a*) The south-western group :—

Limnodynates dorsalis, Crinia georgiana, C. signifera, C. leai, Hyperolia marmorata (?), Heleioporus albopunctatus, Pseudophryne australis (?), P. guentheri, Myobatrachus gouldii, Hyla rubella, H. ewingii var. *calliscelis, H. adelaidensis, H. aurea* (11 + 2 ?).

(*b*) The north-western group :—

Limnodynastes ornatus, Chiroleptes australis, C. alboguttatus, C. breripalmatus, Pseudophryne guentheri, Hyla caerulea, H. peronii and var. *rothii, H. latopalmata* (8).

It is convenient to add here for comparison a list of the species known from the Northern Territory (Port Essington and the Daly River), compiled from the B.M. Catalogue, with the addition of *C. dahlii*, recently described by Mr. Boulenger from the Daly River (P.Z.S. 1865, p. 857) :—

Limnodynastes dorsalis, L. ornatus, Crinia georgiana, Chiroleptes australis, C. dahlii, Heleioporus albopunctatus, Hyla freycineti, H. nasuta, H. rubella, H. peronii, H. adelaidensis, H. aurea, H. caerulea, H. affinis, Hylella bicolor (15).

The first or south-western group is characterised by (1) the poor representation of the two dominant genera Limnodynastes and Hyla, or indeed of any genus except Crinia, which is not numerically strong in species; (2) by a poverty of peculiar genera (one) and species (two, *C. leai*, and *M. gouldii*) ; and (3) by the absence of Chiroleptes, a characteristic which it shares in common with the south-eastern fauna. Four of the species (including a varietal form) are represented in Tasmania and Victoria; three

(possibly four) in Southern South-Australia, six (?) in New South Wales; three in the Northern Territory; and only one (*H. rubella*) in Central Australia, but with *P. guentheri* (?) as an outlier near the Fraser Range.

The opinion of Sir Joseph Hooker that "South-western Australia is the remnant of the more extensive and more isolated portion of the continent in which the peculiar flora was principally developed" has met with universal acceptance among botanists. Professor Tate in subdividing Australia into botanical subregions, has applied the name Autochthonian to the south-west corner of West Australia, whose internal boundary coincides with the rainfall limit of 25-30 inches per annum.

In his very able Summary of the results of the Horn Expedition to Central Australia, Professor Baldwin Spencer discusses the interesting question of the claim of the botanical Autochthonian province to be considered also a zoological Autochthonian province. From the evidence afforded by the Vertebrata, Professor Spencer arrives at the conclusion that "we find no great [zoological] Autochthonian region occupying the western and south-western part of the continent."

The revised lists of the Batrachia of Tasmania and West Australia now brought forward are certainly a little more satisfactory than those at the disposal of the author of the Summary. But such additional evidence as they afford only goes to strengthen Professor Spencer's position. South-western Australia is now practically isolated except on the north, but there is clear evidence of former relations with Victoria and Tasmania and with the Centre. Its batrachian fauna, as we know it, is a poverty-stricken one, with but little if any marked character of its own, and may well be mainly if not altogether of derivative origin.

The second or north-western group of species seems to have very little (one species *P. guentheri*) in common with the south-western group; but more diligent collecting would probably alter this state of things to a considerable extent. At present all that need be said of it is that the fauna of the north-west stands in sharp contrast to that of the south-west by the presence of no

less than three species of Chiroleptes, and by the presence of five other species which also extend to Eastern or Central Australia.

In the fauna of the Northern Territory as known to us, there is only a single endemic species (*C. dahlii*); but the increase in the number of species of Hyla is very noticeable. As a whole the fauna is allied on the one hand to that of South-western Australia; and on the other, more closely perhaps to that of Queensland and of New South Wales. As far as present knowledge goes Port Essington appears to be the eastern limit of *Crinia georgiana*, *Heleioporus albopunctatus*, and *Hyla adelaidensis*, and the western limit of *Hyla freycineti*, *H. nasuta*, *H. affinis*, and *Hylella bicolor*. But these and cognate matters can be more satisfactorily discussed when the Batrachia of Queensland come under review.